BOSTON UNIVERSITY

Space Physics Seminar
Thursday, September 18, 2014

Kelvin-Helmholtz Instability at the Magnetospheric Boundary

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3:30 pm
Refreshments
CAS Room 500

4:00 pm
Seminar
CAS Room 502

Abstract:

The Kelvin-Helmholtz instability (KHI) can be excited in hydrodynamic fluids or plasmas and is driven by velocity shears. It has generated a long-standing interest in magnetospheric community, since it has long been recognized that magnetospheric boundaries can be unstable to KHI. Particularly during geomagnetic storms, the interest to the KHI is motivated by its coupling with magnetospheric body modes which drive ultralow frequency waves that affect radiation belt particle fluxes. However, even during quiet conditions, the KHI is deemed to be important for plasma and momentum transport from the magnetosheath flow to the magnetosphere across the low-latitude boundary layer. Characteristic signatures of the KHI have been observed in situ at magnetospheric boundaries, and a large body of local plasma simulations, including magnetohydrodynamic (MHD) and more refined plasma models, have been carried out. However, studies of the KHI in global magnetosphere simulations have only started to be pursued relatively recently because the need to resolve both global and local scales makes them challenging computationally.

Recent advances in building massively parallel extremely high-resolution global MHD simulation codes now have allowed studying the KHI in a global magnetospheric setting. In this presentation, I will describe recent results obtained using the Lyon-Fedder-Mobarry (LFM) global MHD model. I will concentrate on northward IMF conditions, as they afford a study of pure KHI modes uncontaminated by reconnection-induced flows. It will be demonstrated that the KHI has a global three-dimensional character, whereby the surface-modes are coupled to body modes and drive global fluctuations of the plasma sheet. I will describe the spectral properties of the instability as well as its eigenmode structure and the structure of the boundary layer. The linear growth rates are also calculated and found to be in excellent agreement with predictions from linear theory.

Next Week

- Toni Galvin
  University of New Hampshire
- Solar Wind Trends in the Current Solar Cycle – the STEREO Perspective

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